Claims

1. Method for decomposing biologically and/or chemically waste containing organic matter, which method comprises

- waste pretreatment and
- actual biological and/or chemical decomposition treatment in the decomposition reactor (12, 14) or the like, which decomposition is at least partly realised by using microbes, typically aerobic and/or anaerobic bacteria, characterised in that

waste pretreatment comprises waste fragmentation and homogenisation in a pretreatment apparatus (10a, 10b) operating on the principle of a multi-ring double action impact mill, which comprises

- a housing (26) equipped with a feed opening (24) and a discharge opening (25, 27′),
- a first rotor (62) disposed inside the housing, which rotor is equipped with blades (1a,b,c...,3a,b,c,...,...) having impact surfaces (a′, b′, c′,...,), and which blades form at least one or more, typically at least two, rings (1, 3, 5) that are coaxial with the said rotor, and
- a stator disposed inside the housing coaxially with the first rotor (62), or another rotor (64) rotating in the opposite direction, and which stator or other rotor are equipped with blades (2a,b,c..., ...) having impact surfaces (a′, b′, c′,...), these blades forming at least one or more, typically at least two, rings (2, 4, 6) fitted coaxially with the said stator or other rotor, and which rings are disposed so as to be staggered in relation to the ring or rings of the first rotor,

whereby the waste is fed through the feed opening (24) of the pretreatment apparatus (10a, 10b) into the hub of the rings (1, 2, 3, ...7) formed by the blades (1a, b, c,...2a, b, c,...,...,7 a, b, c,...), from where the waste is arranged to move by the effect of a rotor or rotors (62, 64) to the outermost ring of the ring (7) formed by the outermost blades (7a, b, c,...,), and further to the discharge opening (25, 27′) at the outermost ring.

2. Method according to claim 1, characterised in that the waste consists of biologically degradable components containing solid matter and/or sludge such as

community waste, sludge from waste water purification plants, agricultural waste such as waste from livestock husbandry and slaughter waste, waste from the fishing industry, gardening waste, waste from the food industry and/or other industrial waste.

3. Method according to claim 1, characterised in that

- waste pretreatment comprises forming a pumpable sludge from the waste, the sludge typically having a 10 - 30% dry matter content, whereby
  - the necessary amount of liquid such as raw water, process water, waste water or sludge having high liquid content, is added to the waste to form a sludge and,
  - the waste is fragmented in the pretreatment apparatus to a suitable particle size favourable for forming sludge, typically, to a grain size where more than 95% of the particles are under 5 mm, most typically so that more than half are under 3 mm and that
- the actual decomposition treatment of the waste comprises digestion of the sludge formed in the pretreatment stage using anaerobic bacteria, in which case biogas containing carbon dioxide and methane gas etc. is produced as a decomposition product.

4. Method according to claim 1, characterised in that, in addition to the waste flow entering and/or leaving the pretreatment apparatus (10a) are added

- microbes promoting biological degradation of waste such as anaerobic or aerobic bacteria and/or other substance promoting waste decomposition such as a catalyst or enzyme,
- microbe-containing process water that has been separated from the waste after pretreatment, or during or after actual decomposition treatment, is added to the waste flow, and/or
- microbe-containing treated waste, derived from the pretreatment apparatus or actual decomposition process, which waste is recycled to the feed opening of the pretreatment apparatus.

5. Method according to claim 1, characterised in that air is removed during the pre-treatment process, typically using nitrogen scavenging, from the waste to be pretreated for anaerobic decomposition treatment.

6. Method according to claim 1, characterised in that

- waste to be pretreated for aerobic decomposition treatment is aerated in the pretreatment apparatus by adding a drying agent, such as small branches, bark, chips, straw, dry hay or peat to the process.

7. Method according to claim 1, characterised in that it comprises the following successive stages in which

- treated waste discharged from the first pretreatment (10a) is degraded biologically in the actual decomposition process (12) using anaerobic bacteria, so that biogas containing e.g. methane and carbon dioxide is produced,
- the liquid that is excessive for further treatment is separated from the solid matter left over from decomposition treatment (12), and the remaining solid waste is conveyed to the second pretreatment (10b) to be treated in the pretreatment apparatus operating on the principle of a multi-ring double-action impact mill, and
- the pretreated waste discharged from the second pretreatment apparatus (10b) is degraded biologically in the second decomposition treatment (14) using aerobic bacteria, or by gasifying the waste in a gasification reactor, so that e.g. carbon monoxide and hydrogen-containing gas etc. is formed, that can be used as a fuel.

8. Method according to claim 8, characterised in that the waste treated in the first decomposition treatment is treated in the second pretreatment apparatus

- by grinding the waste to a suitable particle size suitable for the second decomposition treatment and
- by aerating the waste by adding a drying agent, such as small branches, bark, chips, straw, dry hay or peat in the second pre-treatment apparatus.

9. Method according to claim 1, characterised in that the method comprises hydrolysing (43) of waste using hydrolysing bacteria in a hydrolysis reactor between the pretreatment in a pretreatment apparatus and the actual decomposition using anaerobic bacteria in a decomposition reactor.

10. Method according to claim 1, characterised in that the waste is prepared for pretreatment
- by removing oversized metallic or other non-organic particles from the waste using coarse screens, a metal separator (20), by hand or by another suitable method and/or
- by crushing the oversized particles.

11. Method according to claim 1, characterised in that the waste pretreatment is continuous and that the dwell time of the waste in the pretreatment apparatus is < 10 seconds, typically less than 5 seconds, most typically less than 1 second.

12. Method according to claim 1, characterised in that
- waste is pretreated in a pretreatment apparatus at either over- or underpressure and/or that
- the temperature of the waste is raised in the pretreatment apparatus, for example, by introducing warm liquid or steam to the waste.

13. A pretreatment apparatus (10a, 10b) for biodegradable waste, in which the waste and additional substances possibly added into the waste such as microbes, catalysts, enzymes, liquids, drying agents, are fragmented and homogenised before actual decomposition in the decomposition reactor (12, 14), characterised in that the apparatus, which operates on the principle of a multi-ring double action mill, comprises
- a housing (26)
- a first rotor (62) disposed inside the housing, which rotor is equipped with blades (1a,b,c,...,3a,b,c,...7a,b,7c,...) having impact surfaces (a′, b′, c′,...) and which form one or more, typically at least two rings (1,3,5...7) coaxial with said rotor, and

- a stator or another rotor (64) rotating in the opposite direction, fitted inside the housing coaxially with the first rotor, which stator or other rotor is equipped with blades (2a,b,c,...,) having impact surfaces (a′,b′,c′,...,) and which form one or more, typically at least two rings (2, 4, 6,...) coaxial with the said stator or other rotor, and which are arranged so as to be staggered in relation to the ring or rings of the first rotor,
- a feed opening (24) in the housing, which is connected to the hub of the rings (1,2,3,...7) formed by the blades, and
- a discharge opening (25, 27′) formed in the housing, which opening is at the outermost ring (7) of the outer ring formed by the blades.

14. Apparatus according to claim 13, characterised in that the apparatus is continuously-operating.

15. Apparatus according to claim 13, characterised in that the discharge opening (25, 27′) is connected to the waste conveyor pipe (32),
- in which there is a pump (38) to transport the pretreated waste in the said pipe, and
- that has a flow connection to the actual decomposition reactor (12).

16. Apparatus according to claim 13, characterised in that there is a pipe (36) or the like that transports the pretreated waste discharged from the discharge opening (25, 27′) back to the feed opening.

17. Apparatus according to claim 13, characterised in that the housing walls (26′) are located at a certain distance from the outer ring of the outermost ring (7) formed by the impact surfaces of the stator/rotor, whereby beyond the outermost ring formed by the impact surfaces remains an open outer ring; from where the waste or sludge can be flung out radially in several directions, advantageously to be discharged through the discharge opening (27′) located at the bottom (27) of the housing.

18. Apparatus according to claim 13, characterised in that the housing walls (26′) form a channel (25′) equipped with a tangential discharge opening around the outer ring of the outermost ring formed by the impact surfaces of the rotors/stator, which channel guides the waste being flung outwards from the outermost impact surfaces to travel tangentially toward the discharge opening (25).

19. The use of the apparatus according to claims 13 - 17, characterised in that it is used in pretreatment of waste containing organic matter, before the waste is degraded biologically in a decomposition reactor using anaerobic or aerobic bacteria, or using the apparatus before hydrolysing or gasifying biological waste that occurs in association with the actual decomposition reaction.